

REMARKS

The Official Action mailed December 20, 2010, has been received and its contents carefully noted. Filed concurrently herewith is a *Request for One Month Extension of Time*, which extends the shortened statutory period for response to April 20, 2011. Accordingly, the Applicant respectfully submits that this response is being timely filed.

The Applicant notes with appreciation the consideration of the Information Disclosure Statements filed on July 27, 2006; September 21, 2006; November 9, 2009; April 14, 2010; September 30, 2010 and October 8, 2010.

A further Information Disclosure Statement was submitted on December 22, 2010, and consideration of this Information Disclosure Statement is respectfully requested.

Claims 1-9, 13-21 and 25-36 were pending in the present application prior to the above amendment. Claims 1-9, 21 and 28-36 have been canceled without prejudice or disclaimer and claims 13-20 and 25-27 have been amended to better recite the features of the present invention. Accordingly, claims 13-20 and 25-27 are now pending in the present application, of which claims 13, 15 and 16 are independent. For the reasons set forth in detail below, all claims are believed to be in condition for allowance. Favorable reconsideration is requested.

Applicant's representatives take this opportunity to thank Examiner Wilson and Examiner Shosho for the courtesies extended during the April 5, 2011 personal interview. Applicant's summary of the substance of the personal interview is incorporated into the following remarks.

Paragraph 3 of the Official Action objects to claim 30-36 as being of improper dependent form for failing to further limit the subject matter of a previous claim. In response, claim 30-36 have been canceled. Accordingly, this objection is moot.

Paragraph 6 of the Official Action rejects claims 1-3, 5, 6, 8, 9, 13-15, 17, 18, 20, 21, 25-33, 35 and 36 as obvious based on the combination of U.S. Publication No.

2003/0218418 to Sato, U.S. Publication No. 2002/0086180 to Seo and U.S. Patent No. 6,084,176 to Shiratsuchi. Paragraph 7 of the Official Action rejects claims 1, 4, 7-9, 13, 16, 19-21, 25, 26, 28, 30, 31 and 34-36 as obvious based on the combination of Sato, Seo and U.S. Patent No. 5,487,953 to Shirota. The Applicant respectfully traverses the rejections because a *prima facie* case of obviousness cannot be maintained against the independent claims of the present application, as amended.

As stated in MPEP §§ 2142-2144.04, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some reason, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some reason to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

Claims 1-9, 21 and 28-36 have been canceled. Accordingly, the rejections of these claims are moot. With respect to remaining independent claims 13, 15 and 16, the prior art, either alone or in combination, does not teach or suggest all the features of the independent claims, as amended. Specifically, as discussed during the interview, rejected independent claims 13, 15 and 16 have been amended to recite a hole transporting layer comprising an aromatic amine compound. Additionally, in these claims, the "organic compound" has been changed to a "carbazole compound" in order

to clearly distinguish it from the compound included in the hole transporting layer. Finally, the first and second electrodes have been defined as an anode and a cathode, respectively, and the layer containing the carbazole compound is clarified to be in contact with the anode.

That is, in the amended independent claims, the organic compound in the layer in contact with the anode is different from the compound in the hole transporting layer, which can be seen by the separate use of the term "carbazole compound" and "aromatic amine compound." Thus, as discussed during the interview, the claims recite a mixture of a carbazole compound and a compound, such as molybdenum oxide, as a hole injection layer, and a separate hole transporting layer comprising an aromatic amine compound. The addition of the separate hole transporting layer is advantageous to minimize quenching that can otherwise occur. The use of a carbazole in the hole injection layer provides several advantages, including: (1) use of a carbazole compound results in improved thermal stability over, for example, an aromatic amine because of the additional bond between the benzene rings, with the resultant synergistic effect of lowering the crystallinity of the layer and to avoid recrystallization and resulting deterioration of the performance of the device; (2) the resultant hole injecting layer has excellent hole injecting and transporting properties such that the driving voltage and light emission efficiency are increased, allowing for an increased layer thickness, reduced power consumption, and improved reliability (see, for example, Applicant's specification at paragraphs [0011]-[0018] (as filed)); and (3) it is easier to form a combined layer of a carbazole compound and molybdenum oxide than a layer of molybdenum oxide itself due to resulting efficiencies during the formation process.

As generally discussed during the interview, it is well known that the traditional organic light emitting element usually possesses a stacked structure formed from a plurality of layers. That is, a component (compound) in a layer is different from a component (compound) in its neighboring layer(s). This difference causes an energy barrier for carrier injection between the neighboring layers, which can lead to an

increase in the driving voltage. Also, it is considered that charge accumulation may occur at such an interface due to the energy barrier (see, paragraphs [0016] to [0026] of Seo). Thus, an objective of Seo is to reduce the energy barrier between neighboring layers without an increase in the number of interfaces between the layers (paragraph [0032]). One of the methods to achieve this objective is the formation of a mixed layer. That is, two different compounds, which are separately provided to different layers that are neighboring to each other in a traditional light emitting element, are mixed, by which the functions of two layers are simultaneously obtained from the single mixed layer. For example, a hole injection compound and a hole transporting compound are mixed to form a single mixed layer that functions not only as the hole injection layer but also as the hole transporting layer (paragraph [0033] to [0038]). In this case, only one layer is necessary between the anode and the light emitting layer, while normally two layers (hole injection layer and hole transporting layer) are required between the anode and the light emitting layer in a traditional light emitting element. Again, the concept of Seo requires the mixing of two materials, which are traditionally provided in two neighboring layers. In other words, Seo does not teach the arbitrary mixing of any kind of compounds, and the compounds to be mixed are strictly limited to those provided in the layers neighboring to each other, by which a reduction of the number of the layers can be realized.

As discussed during the interview, Seo is not combinable with Sato to achieve the claimed invention. As set forth in the Official Action, Sato teaches a hole injection layer over an anode and a hole transporting layer over the hole injection layer, and further teaches a metal oxide as a hole injection material. However, as discussed above, Seo has a limitation on the "mixing" to reduce the number of the layers. Therefore, if one were to look to the teachings of Seo and combine or mix the hole injection material and hole transporting material of Sato, one of ordinary skill in the art would not have then been led to provide an additional hole transporting layer between the mixed layer and a light emitting layer, comprising a material different from the hole

transporting material that is mixed with the hole injection material. This is because the insertion of the additional hole transporting layer would not contribute to the reduction of the number of layers, which is the main objective of Seo's teachings. In other words, the alleged combination of Sato with Seo would not have led one of ordinary skill in the art to provide a structure as defined in the amended claims. Applicant, however, can provide the additional hole transport layer to distance the combined layer from the light emitting layer to minimize quenching.

Moreover, as discussed during the interview and referenced above, there are several advantages achieved by the claimed use of a carbazole mixed with an inorganic compound such as molybdenum oxide in the hole injection layer. Because of the extra bond in carbazole compared to an aromatic amine compound, improved thermal stability is provided that has the resultant synergistic effect of reducing crystallinity of the layer and resulting deterioration of the performance of the hole injection layer. This in turn improves the driving voltage and light emission efficiencies. Because of the increased efficiency, the hole injection and transport layer thicknesses can be varied to minimize quenching, improve device reliability, and better control undesirable optical characteristics such as interference. Finally, it is easier to form a combined layer of a carbazole compound and molybdenum oxide than to form a layer of molybdenum oxide alone.

Shiratsuchi and Shirota fail to overcome the deficiencies of Sato and Seo. While Shiratsuchi discloses a carbazole, it is provided in a hole transporting layer not in a hole injection layer in contact with an anode.

Because Sato and Seo in view of Shiratsuchi or Shirota do not teach or suggest all the claim limitations, a *prima facie* case of obviousness cannot be maintained with respect to independent claims 13, 15 and 16. Therefore, Applicant believes the rejections of claims 13, 15 and 16 and claims dependent therefrom are not proper.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are in order and respectfully requested.

Paragraph 8 of the Official Action rejects claims 1-3, 5, 6, 8, 9, 13-15, 17, 18, 20, 21, 25-33, 35 and 36 as obvious based on the combination of U.S. Patent No. 7,732,808 to Ikeda and Shiratsuchi. Paragraph 9 of the Official Action rejects claims 1, 4, 7-9, 13, 16, 19-21, 25-31 and 34-36 as obvious based on the combination of Ikeda and Shirota.

As acknowledged in paragraph 4 of Paper No. 20100622, Applicant previously submitted a verified English translation of Applicant's priority application No. 2005-085056 filed March 23, 2005 in Japan and has thus perfected the claim for priority entitling Applicant to an effective U.S. filing date as of March 23, 2005.

Ikeda has an earliest effective U.S. filing date of September 24, 2004 (its international filing date as the WIPO publication was in English and designated the U.S.), which is less than one year prior to Applicant's effective filing date of March 23, 2005. Additionally, Ikeda's WIPO publication date of April 7, 2005 and U.S. publication date of June 8, 2010 are both after Applicant's effective U.S. filing date.

As such, Ikeda is now only potentially available as prior art under § 102(e). However, Ikeda, as a commonly owned reference under § 102(e), may not be considered for a rejection under § 103. Subject matter developed by another, which qualifies as prior art only under one or more of subsections 35 U.S.C. §§ 102(e), (f) and (g), is not to be considered when determining whether an invention sought to be patented is obvious under 35 U.S.C. § 103, provided the subject matter and the claimed invention were commonly owned at the time the invention was made. See MPEP § 2146 and 35 U.S.C. 103(c). Since the disclosure by Ikeda and the claimed invention of the present application were, at the time the invention was made, subject to an obligation of assignment to Semiconductor Energy Laboratory Co., Ltd., Ikeda may not be considered for a rejection under § 103. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are in order and respectfully requested.

Paragraph 11 of the Official Action rejects claims 1-3, 5, 6, 8, 9, 13-15, 17, 18, 20, 21, 25-33, 35 and 36 under the doctrine of obviousness-type double patenting over

claims 1-10, 15 and 16 of U.S. Patent No. 7,732,808 to Ikeda, in view of Shiratsuchi. Paragraph 12 of the Official Action rejects to claims 1, 4, 7-9, 13, 16, 19-21, 25-31 and 34-36 under the doctrine of obviousness-type double patenting over claims 1-10, 15 and 16 of U.S. 7,732,808 to Ikeda in view of Shirota. The Applicant respectfully submits that the amended independent claims of the subject application are patentably distinct from the claims of the Ikeda patent in view of Shiratsuchi or Shirota.

As is discussed in greater detail above, the independent claims have been amended to better recite the features of the present invention. In light of this amendment, the Applicant respectfully traverses these grounds for rejection and reconsideration of the pending claims is respectfully requested. In any event, the Applicant respectfully requests that the double patenting rejections be held in abeyance until an indication of allowable subject matter is made in the present application. At such time, the Applicant will respond to any remaining double patenting rejections.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized to charge fees under 37 C.F.R. §§ 1.16, 1.17, 1.20(a), 1.20(b), 1.20(c), and 1.20(d) (except the Issue Fee) which may be required now or hereafter, or credit any overpayment to Deposit Account No. 50-2280.

Respectfully submitted,



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